Stillman W. Robinson
A Memorial

S. W. Robinson,

STILLMAN WILLIAMS ROBINSON

A MEMORIAL

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INTRODUCTION

FEELING most keenly the loss, not only to the University but also to the world of science, that had been sustained in the death of Stillman W. Robinson, and desiring to pay a more than passing tribute of respect and love to his memory, the Faculty of the Ohio State University voted to hold a memorial service in honor of its distinguished colleague in the University Chapel on February 22, 1911. The committee having in charge the arrangement of the program sought to have a representative from each university with which Professor Robinson had been identified, and one speaker to represent the large body of alumni who had had the good fortune to be members of his classes in their undergraduate days. In behalf of the University of Michigan, Professor Joseph Baker Davis prepared the address which, in the absence of the writer, was read by Dean Mortimer Elwyn Cooley; Professor Ira Osborn Baker represented the University of Illinois; Mr. Charles Frederick Marvin, '83, the Alumni, and Professor Embury Asbury Hitchcock spoke in behalf of the Faculties of the Ohio State University.

Owing to the rare value of the addresses presented on this occasion, it was decided that they should be brought together in a form of such permanence as their worth suggests. To this end the publication of this volume was authorized by the University. Although it may be highly treasured by those who knew him best, it is but a feeble tribute to the memory of a man whose life and work have touched, in a helpful manner, the lives of so many.

STILLMAN WILLIAMS ROBINSON

Born on a farm near South Reading, Vermont, March 6, 1838.

Apprentice in a machine shop, 1855-1859.

Entered University of Michigan, January, 1861.

Received Civil Engineering degree, June, 1863.

Assistant Engineer, United States Lake Survey, 1863-1866.

Instructor of Engineering, University of Michigan, 1866-1867.

Assistant Professor of Mining Engineering and Geodesy, 1867-1870.

Assistant Engineer and Astronomer in establishing western boundary line of Nebraska, Summer of 1869.

Professor of Mechanical Engineering, University of Illinois, 1870-1878.

Professor of Mechanical Engineering and Physics, The Ohio State University, 1878-1881.

Professor of Mechanical Engineering, 1881-1895.

Inspector of Railways and Bridges, Railroad Commission of Ohio, 1880-1884.

Consulting Engineer for Lick Telescope and Mountings, 1887.

Resigned from The Ohio State University to devote his time to his extensive professional interests, 1895.

Received degree of Doctor of Science, The Ohio State University, 1896.

Title of Emeritus Professor of Mechanical Engineering conferred, 1899.

Was a member of the American Society of Mechanical Engineers; American Society of Civil Engineers; Society of Naval Architects and Marine Engineers; Ohio Society of Mechanical, Electrical and Steam Engineers; Fellow in American Association for the Advancement of Science.

One of the Founders of the Society for the Promotion of Engineering Education.

Death occurred October 31, 1910.

In Behalf of the University of Michigan

JOSEPH BAKER DAVIS, C. E.
Professor Emeritus of Geodesy and Surveying

THE power of a nation is in the character of its men and women. The greatness of a nation is in the ideals of its citizens. The glory of a nation is in the lives of its people. It is these unseen things which endure—that are eternal. By any of these tokens—or by them all—Stillman Williams Robinson was a useful and valuable citizen. So may we remind ourselves of our place and part in the making of the nation.

When the University of Michigan counts up its treasures, it places first its graduates, for by these fruits shall be known the value of its work. Conscious that in honoring one of them, the University is in a sense but honoring itself, it will not withhold a tribute of loyal regard, but plead for the kind indulgence of the natural sentiments of an Alma Mater.

When we meet to honor a man of science, a teacher, or an engineer, and Mr. Robinson was all of these in a most admirable sense of the words, those who observe our devotion naturally ask what has this person done to deserve these tributes of respect. In the case of Mr. Robinson this is not so easy to answer. There is the briefest possible category of his labors prepared by himself some time in 1905 or early in 1906, from which has been taken nearly every fact that has appeared regarding him, except the few reminiscences of friends. This seems to be all that there is. We may be very sure there is no line, nor word, nor hint, in the data furnished by him, giving the slightest clue to his inner life. We may read in the Memorial presented to the American Society of Civil Engineers by Professor Orton and his two associates, that "His early life was that of a country boy, but he had such a love for mechanics that he

served a four-year apprenticeship as a machinist. In this way he earned the money to defray the expenses of his early education and his preparation for college.

"In 1860 he entered the University of Michigan, making the journey from his home principally on foot, and meeting his expenses by working as a machinist." In these simple words are embraced the youthful aspirations that impelled Professor Robinson to his destiny. Let us look within a little and see what this really means. Presumably young Robinson's home was where he was born at South Reading, Vermont, on the sixth of March, 1838. By the time he was twenty-two and one half years of age he had defrayed the expenses of his early education and prepared for college, largely from his own resources. He had served his time, four years, in becoming a real machinist, as his work afterwards showed. He was not merely a tender of machines that did the work. He was a mechanic. Indeed he became a mechanician. This showed how well his four years had been spent.

He presented himself for admission to the University of Michigan after a journey that could not have been less than six hundred and twenty-five miles, made principally on foot. How far he actually traveled, or how long he was on the way we may never know. We can guess how he might have paid his way. How had he learned about the far off University of Michigan, then just beginning to offer courses leading to the degree of Civil Engineer? However, he had learned of it. The fact that he did know of it is a witness of his acuteness in acquiring useful knowledge that was characteristic of him always. We may, perhaps, assist ourselves to realize how far away this University was by reflecting that the sovereign state in which was his home is

about forty-two miles wide at the latitude where he lived. At this time, 1860, the University of Michigan began its course for civil engineers with the sophomore work in the Department of Literature, Science and Arts, and gave the degree after three years of study. Mr. Robinson came prepared to enter upon this course of study. So we find him at twenty-two and one-half years of age entering the University, really a self-made, and a well-made man.

About three years after his graduation, namely, in the fall of 1866, he began teaching as Assistant in Civil Engineering under Professor De Volson Wood. At the end of this college year he was made Assistant Professor of Mining Engineering and Geodesy, which position he retained until 1870. He was a teacher in the University of Michigan for four years. His work in the class room was always characterized by personal friendliness for the student; balance and repose on his own part; very adequate knowledge, apparently the result of experience; no thought of himself, his position, place, or dignity; just a kind gentleman who stood always ready to do anything we needed to have done. Discipline never showed itself. There was no need of any. Those who went to college in 1865 to 1870 will better understand what this reference to discipline means. It is no exaggeration to refer to those times as rough,—they were rough in many ways. His success as a teacher was only the fruitage of the character and labors of the young man from Vermont, who, as a student but a few years before, entered the very class-rooms where he was teaching, and was proof that he really was a well-made man, of experience, understanding, and attainments.

His graduation thesis upon the subject of "A New Form of Suspension Bridge," was published in the Journal

of the Franklin Institute, Philadelphia, in 1863, the year he received his degree of C. E. Immediately upon graduation he became an assistant engineer on the United States Survey of the Northern and Northwestern Lakes, commonly spoken of as the Lake Survey, where he remained for three years, and until his return to the University as Professor Wood's assistant. The next year, 1864, he published three more articles in the Journal of the Franklin Institute, two of which follow up the abstruse subject of his thesis and the studies suggested thereby. The third was upon an engineering problem of the rafters. The same year, and in the same journal, appeared his article upon Dr. Brünnow's magnetic break-circuit. Here are three investigations of original problems in the theory of structures and the paper upon the break-circuit, published the next year after graduation, and representing labors in addition to the requirements laid upon him by his position upon the Lake Survey. The next year, 1865, he published in the Journal of the Franklin Institute his papers upon "Leveling and Surveying by Means of the Visual Angle and Rod." Quite likely these papers grew out of his connection with the Lake Survey. What is called the Stadia had been introduced upon the Lake Survey by an assistant engineer named Myers and may have come from Italy. Assistant Engineer Robinson, with others, appreciated the lack of any mathematical basis for the theory of this useful device. The result was the papers here referred to. Possibly there have been but two material additions to this theory since, and it is quite doubtful if there have been any additions to the collection of methods of reducing the field notes of a stadia survey published by him at that time,—forty-five years ago. This is a witness of the comprehensive nature

of his investigations, and the thoroughness with which he carried them out. Men are still bringing out new things relating to stadia reductions that he published before they were born. This was the second year after graduation. In this same year he published in this same journal a continuation of his studies in structural mechanics,—matter at that time sufficiently abstruse. To this he added his paper on the use of the double eye-piece in the determination of the personal equation. It is to be readily doubted if there were a large number of engineers, not to say mathematicians, at that time, who stood ready to attack the problem of the stadia, or to seek to confine within rational bounds the elusive personal equation,—different for every different person and for every hour and circumstance of the day's work. The prohibitive difficulties of a problem, instead of discouraging this recent graduate, only made it seem more desirable to his mind that the thing should be done. He did many impossible things, in those years, and afterwards. The next year, 1866, the third after his graduation, he put forth his paper on "Jets of Water." So his writings continued nearly to the end of his days, as we knew him. They covered an astonishing variety of subjects and there is an astonishing number of them. It may be doubted if he knew how many there are, as he refers to them as some fifty in number, in the memorandum of 1905 or 1906, above referred to; while a search of the library of the University of Michigan reveals seventy contributions of his to engineering knowledge. References are made by him to still other publications of his that were not found. The memorandum of this search ends with the statement that "This is not a complete bibliography." Regarding the range and variety of subjects comprised in this incomplete

bibliography a few references must now suffice. Besides those mentioned before there are the following titles:

Vibration in Extended Media and the Polarization of Sound.

Principles of Mechanism.

Railroad Economics.

Efficiency of the Crank.

Screw Propulsion.

Spiral Springs.

Electric Induction by Stress.

Cutting and Planing Stone.

River Gauging and the Double Float.

Economy in Electric Generation.

Measurement of Gas Wells.

There are also his inventions. He numbers them at about fifty. Some thirty-five or forty of which were patented, he says. The records of the patent office show forty-two patents granted to him. He enumerates nine subjects of his inventions and refers to the rest as "Others for various purposes." As a matter of fact his inventions cover a range and variety of subjects comparable with the exceeding great range and variety of his contributions to engineering knowledge by publication. They also cover the same time,—namely, from his graduation from college until the end of his life. His patent office record begins in 1866, the third year after his graduation and closes with 1910, the year of his death. His first patent appears to have been for an Escapement for Timepieces. His last patent was a Lens Grinding Machine. Between these came some interesting inventions, such as the steam rock drill, a treadle motion without dead points, the telephone (in 1880, but

four years after it was exhibited at the Centennial Exposition, Philadelphia), shoe closing machines, metal piling and substructure, a gauge for measuring the velocity of fluids, a transmission dynamometer, and an automatic air brake. The person somewhat acquainted with engineering operations, manufacturing, and the history of their development, will perceive at once the work of a pioneer, even in this very brief and incomplete list of references. The shoe manufacturing, for which this country is so justly celebrated, was just well under way,—the main difficulties overcome,—in 1882 and 1884, when he received his first patents for shoe closing devices that led to his really wonderful inventions that were so successful mechanically, as well as otherwise. Here one might pause to consider a marked characteristic of all his mechanical inventions. He was never satisfied with anything in this line that was not a material embodiment of mechanical principles so nearly perfect as to astonish any competent observer of his work, and often fill them with wonder at his daring and his success. In some particulars his shoe closing machine is an illustration of this, which a qualified person might use as the subject of a paper, or article, of considerable length. The telephone is referred to above as the subject of an invention of his while this useful device was still almost, if not quite, at the beginning of its commercial history. The steam rock drill, another instance in point was, in 1867, the date of his first rock drill patent, in its very infancy. Much inventing and experimenting, had preceded the allowance of this patent. Mr. Robinson was associated with Professor De Volson Wood in bringing out this drill, and it became the property of Professor Wood afterwards, I believe. I saw one of these drills returned to Ann Arbor after six months in the

Hoosac Tunnel, which was accounted about the worst place a rock drill could be set to work, and fifty cents would have made it about as good as new. There had been no repairs at all. It had been at the heading every day and at work. Two men could do anything with it. It would even feed itself up to the work and begin drilling with no attention. It had been at work beside drills that were reported to require sixteen men to keep one of them running, counting the men in the repair shops and at the heading. It was really automatic. This will testify to the quality of the inventions made by Mr. Robinson and also to the mechanical skill and faithful care with which they were perfected experimentally. He never was satisfied with a device because it worked. It had to be as good as he could make it, and he had to believe it to be better than others of its kind.

He was a pioneer in the field of experimental instruction in engineering. As early as 1865 to 1870 the ideas now accepted as fundamental in this field, had become settled convictions of his, and he was endeavoring to have them put in practice. Quite likely he left the University of Michigan in 1870 and went to the University of Illinois as Professor of Mechanical Engineering and Physics, because of the better promise afforded there for carrying out, in the instruction of students, the ideas he held regarding experimental work, more particularly in shop practice. How well he comprehended the situation is attested by the millions of dollars now invested in buildings and equipment for the carrying out of the ideas that were vital realities to him forty-five years ago. His place in this field of endeavor is a most honorable one whose value to the engineering profession is not likely to be overestimated.

With these brief, incomplete, and in a measure unsatisfactory, references to his labors this account of him must close. No attempt has been made to prepare a memorial of him, this farmer boy, who as a young man trudged from Vermont to Michigan; became a civil engineer, a mechanical engineer and an educator, whose labors now pervade and characterize the instruction given in schools of engineering. He was also an astronomer, an inventor of useful machines and scientific apparatus, a discoverer in the fields of applied science, an administrator, and a scientist of distinction. What is offered here is only to tell about him as he was known, respected, and esteemed at the University of Michigan.

In Behalf of the University of Illinois

IRA OSBORN BAKER, C. E., D. Eng.
Professor of Civil Engineering

STILLMAN W. ROBINSON began service in the University of Illinois January 1, 1870, as Professor of Mechanical Engineering and Physics; and he held that position until September 1, 1878, when he resigned to come to the Ohio State University, greatly to the regret of all connected with the University of Illinois.

It is the speaker's privilege to bring greetings to this University from the sister institution where Professor Robinson began his career as a teacher of mechanical engineering, and it is his duty to give an account of the pioneer work of Professor Robinson at the University of Illinois and of the effect of his work upon the development of that institution and of its influence upon engineering education; but before entering upon the more formal portions of this address, the speaker desires to bear testimony as to his admiration of the personal character of Professor Robinson. The speaker entered the University of Illinois as a student only a little more than a year after Professor Robinson began his labors there; and for two years the speaker was in classes personally taught by him, and for four years was intimately associated with him as assistant in physics laboratory practice. The speaker considers himself fortunate to have received instruction from so enthusiastic and able a teacher, to have had the inspiration of contact with one possessing the scientific spirit in so high a degree; and is proud to have had the personal friendship of him in whose honor we are met to-day.

To the people of the state of Illinois more than to those of any other state was due the passage by Congress of the act which has resulted in the establishment of forty-five or forty-six institutions of higher learning, among them the

University of Illinois and later the Ohio State University, in which, as the law declares, instruction in agriculture and the mechanic arts shall be a leading object. Among the first of these institutions was the Illinois Industrial University, which, twenty years after it was opened, became the University of Illinois. Such an institution was in large part without precedent or example; and the difficulties in the development of the infant university were greatly increased, as it afterwards developed, by the broad and far-sighted determination of those in charge to give the most liberal interpretation to the acts of Congress and of the state legislature, and to establish an institution of the broadest scope, one which should give instruction in the branches of learning relating to agriculture and the mechanic arts, but which should not exclude other scientific and classical studies. The numerous appeals, pamphlets, and conventions by the people of Illinois leading to the act of Congress, and to that of the legislature establishing the University of Illinois, developed widely different ideas and ideals in the minds of the people in the state at large and also in the Board of Trustees, as to the field and the character of instruction to be given by the new institution; and for many years after it was opened, there was a conflict as to the work the University might wisely or legally undertake. Not a few desired to limit materially the field of what has become the College of Literature and Arts, and many others were in opposition to the University because the College of Agriculture did not run before it could walk, or because certain things were not done and because some other things were done. This difference of views among men, perhaps all equally earnest to promote the most useful form of education, seriously retarded the growth of the University; but

notwithstanding the severe criticism of other branches of the University, from the beginning the work of the College of Engineering had the hearty aproval and undivided support of all, largely because of the ability and insight of its first professor, Stillman W. Robinson.

The work of the Engineering College may be said to have begun January 1, 1870, when he entered upon his duties as professor of mechanical engineering. In the published proceedings of the Board of Trustees there are numerous reports of the Regent and of committees of the Board which show an earnest desire to do everything in their power to promote instruction in the mechanic arts; but there seems to have been no very definite conception of the object to be accomplished or of the methods and appliances to be used, until the advent of Professor Robinson. Reference is frequently made to a shop established almost as soon as instruction was started, but this shop occupied much the same relation to the University that the farmer's tool-room does to the work of his farm. It consisted of a few carpenter's tools in a small room cut off from a mule-stable. Professor Robinson was elected December 13, 1869, and entered upon his work January 1 following. Ten days thereafter he appeared before the Board of Trustees and presented a communication, in which he forcibly stated the reasons for uniting theoretical and practical instruction, and outlined his method of accomplishing this. The Professor asked for $2,000 for the purchase of certain tools and apparatus, a very large sum considering the state of engineering education and the condition of the University's finances at that time; but apparently the Board recognized that the newly elected Professor was a man of force who had definite ideas about the subject in hand, and the appropriation was promptly

granted, the mules were driven out of the 24 by 30 building used as both a shop and a stable, and the carpenter's tools were moved to a second story added for that purpose. A steam-boiler, an engine-lathe, a few tools, and the partly finished castings for a steam-engine were purchased; and the Professor, with the help of his students, proceeded to make a 10-horse power steam-engine which had some novel features to adapt it to experimental purposes. In the succeeding summer vacation the speaker visited this shop, and was greatly impressed by seeing the Professor and his students working upon this engine. Thus was opened the first distinctly educational shop in America, and seven years elapsed before another similar shop was opened in the United States. The University of Illinois and Professor Robinson have never received the credit due for this pioneer work in educational shop practice, the first in this country, and probably the first in the world. In less than a year after the opening of this small shop in a mule-stable, the Legislature appropriated $25,000 for a new mechanical and military building, which is the strongest evidence of the approval of the methods of instruction employed.

In the beginning the shop was run upon what may be called a commercial basis; that is, the students were employed in turning out articles of commercial value, and were incidentally instructed by the foreman as to the best method of performing the particular operation. The shop for several years took contracts for making certain articles for dealers, the most noted of which were power hay-forks and wind mills; and also repaired such machinery as was sent to it for that purpose from the surrounding agricultural community, among which the most common were mowing machines and corn shellers. The Department of Mechanical

Engineering under Professor Robinson's direction also made apparatus for other departments of the University, for example, a dozen microscope stands for the Department of Botany. There were two all-compelling reasons for this departure from what is now usually considered good pedagogical practice. In the first place, the University of Illinois was greatly handicapped by lack of funds, since the State supplied money only for buildings, and there were untold demands upon the meager sum obtained from the endowment; and consequently it was decreed that the shop must be self-supporting, and the Professor in charge adopted the only course open to him, and engaged in commercial manufacturing. In the second place a prominent ideal in the discussions leading to the founding of the so-called Land Grant Colleges was the establishment of institutions "at which the poor boy could get an education"; and for the first few years of its history this idea dominated at the University of Illinois, and every effort was made to furnish remunerative labor to students. The Mechanical Engineering Department under the direction of Professor Robinson was surprisingly successful in meeting this demand; but he had vastly higher ambitions than merely to run a shop in which students could earn enough to keep body and soul together while they obtained a meager education. He was very desirous to have the opportunity and the facilities for giving instruction in the more far-reaching elements of a technical education; in a word, he was ambitious to have a technical laboratory and not a mere shop. In view of the conditions under which he labored in those days, it is surprising that he was able to do any real laboratory work, to make tests and to perform experiments; and notwithstanding the almost insurmountable limitations, he did give

real laboratory work. For example, after a lapse of more than a third of a century, the speaker can recall the following which he saw as he happened about the so-called shop, but in which he had no part. Professor Robinson and his students measured the efficiency of the steam engine then furnishing power for the shop under various conditions as to cut-off and load; determined the amount of power required to run the various machine tools in the shop; designed and made an air-compressor in order to investigate the flow of air through orifices.

But Professor Robinson did more than establish a shop in which was given an education based upon sound pedagogical principles. The work in his recitation room was a unique innovation that was an inspiration to his students. The class-room work in machine design was professedly instruction in invention; and while it violated some principles in education, it was eminently successful in arousing the enthusiasm of the students, and it is certain that the results justified the method. With small classes and a genius for a teacher, some of the more staid rules of educational practice may be disregarded. The fact that Professor Robinson is the inventor of about forty successful and valuable machines and inventions that are not patented, is some evidence that the class-room work was neither aimless nor useless, and conformed to good mechanical practice. Of the machines designed in the class-room and made in the shops of the University of Illinois by students under the direction of Professor Robinson, the writer recalls the following, the enumeration of which will, at least, show something of the character and scope of that work: 1. Chronologically, a 25-horse power steam-engine which furnished the power for the shop for twenty-five years, and which had

several features about it which a distinguished mechanical engineer informs me were twenty-five years ahead of the times, but which were then new and which are now regarded as standard practice. 2. A considerable number of ingenious and novel mechanical movements for use in the recitation room. 3. Numerous pieces of illustrative physical apparatus including a chronograph. 4. An automatically directed heliotrope for the United States Lake Survey. 5. A lawn mower for the University. 6. An odontograph, an instrument to facilitate the laying out of gear teeth of scientific form,—an instrument, I am told, that directly and indirectly materially improved mechanical practice in this important field. 7. A tool for trimming photographs to an oval form, a device which for several years was made in the shops of the University of Illinois by students and shipped all around the world. 8. A machine for automatically graduating thermometer scales, which seems to be the sole one in use in the world to-day. For six or eight years all that were in use were made in the shop of the University of Illinois under the personal direction of Professor Robinson. 9. A sewing-machine without any dead center which was astonishingly easy to start and also easy to keep going. 10. And last, chronologically, a tower clock of novel design that for thirty-two years has continued to announce the time accurately.

Again, Professor Robinson was more than the professor of mechanical engineering, for during the eight and one-half years he was connected with the University of Illinois, in addition to his duties as professor of mechanical engineering, he taught mining engineering and physics. His work in physics, in scope and novelty, was second only to that in machine design; but time will permit a mere mention of only

two typical cases. When the class was studying mathematical optics, he proposed as a problem for the students the design of a spectacle lens which should be free from the reflection that frequently annoys the auditors of a public speaker. It is unnecessary to say that the students neither individually nor collectively were able to solve the problem; but the next day the Professor presented and explained to the class the equations which he said solved the problem, and later in the term he exhibited a pair of spectacles made to his order according to his own formula, which really was free from the annoying reflections of ordinary spectacle lenses. The second example is of an entirely different nature. Before the days when a professor of physics could have an unlimited electrical current by simply turning a key on his lecture-room desk, Professor Robinson set a dry goods box in a window of his recitation room, placed therein two hundred platinum-acid-porous-cup batteries with which he generated the electrical current for an arc light and with some poor lenses and prisms simply set upon a table projected the spectra of metals as large as the side of his lecture-room, and discussed before his students the bearing of his experiments upon the then current theories of the physical constitution of the atmosphere of the sun.

In still another field Professor Robinson was more than a professor of mechanical engineering and physics, for during the first two or three years he gave all the technical engineering instruction; and as long as he remained at the University, he taught some of the leading subjects taken by all engineering students. His work in resistance of materials and in hydraulics was fully as stimulating and creditable as his work in machine design and in physics. In these subjects there was no apparatus, but he so enthused his students

that they were willing to work on Saturdays and in vacations constructing apparatus in order that they might make experiments. Thus was implanted in his students one of the highest forms of education. One piece of apparatus proposed by him to his class in hydraulics, made by his students in the shop, and tested by them in the river at Danville, Illinois, thirty-three miles from the University, furnished the data which enabled him to refute the fallacious theories of two eminent authorities in river hydraulics; and ten years later this same improved Pitot's tube was the only apparatus that could accurately measure the outflow of natural gas from wells in Ohio and Indiana.

But incidentally Professor Robinson performed a greater service to the University of Illinois and to the cause of engineering education than to devise instructive apparatus or to conduct interesting experiments. Many people believed that that institution was founded as a protest against past educational practice; and many, if not most, of those seeking preparation for the practice of engineering misapprehended the purpose and the method of what is now universally recognized as the most approved form of engineering education. Many of the students of that day thought that the sole purpose of the college was to give them engineering information in a predigested form. Fortunately for the University of Illinois, Professor Robinson had clear and correct conceptions as to the better forms of engineering instruction, and his methods and ideals dominated in the early history of the College of Engineering. Almost contemporaneously with the coming of Professor Robinson to the University of Illinois, there was published what has rightly become a noted engineering handbook, in which it was boldly asserted that the higher mathematics were use-

less to an engineer. This statement greatly impressed the engineering students of that day, and strongly tended to alienate them from that mathematical and scientific preparation now universally recognized as necessary for any reasonable engineering education. Professor Robinson's versatility, ability, and enthusiasm in his work were very effective in leading students to adopt the better ideals of an engineering education. He did this by force of his example, without argument or ostentation, just as the light of the rising sun dispels the fog, gloom, and darkness of the night.

In still another way, Professor Robinson performed a service of inestimable value to the cause of engineering education, and particularly to the future of the College of Engineering of the University of Illinois. For several years after that institution was inaugurated, there was much skepticism among practicing engineers as to the possibilities of giving by college instruction, any conception of the principles and practice of engineering. In those days engineering students, and particularly those of the then newly founded University of Illinois, found it unwise to disclose the fact that they had taken collegiate training in engineering; but Professor Robinson's acquaintance with practicing engineers enabled him to help students to positions where they were able to demonstrate the value of their engineering education, and thus aided in dispelling, in some quarters at least, doubts as to the value of collegiate instruction in engineering.

Finally, Professor Robinson's work contributed materially to the general interests of the University of Illinois in a still more important way. The work of the College of Engineering was more easily exhibited to the public and

more easily understood by all than the work of most other departments, and hence it contributed a large share to the early reputation of the University, a reputation which the struggling institution greatly needed in those early days. "The engine designed in the class-room and made in the shop by the students," as the phraseology always ran, was frequently pointed out with pride by president, faculty, and students; and the personal accomplishments of Professor Robinson were frequently referred to in public and in private, in discussing the success of the University. Under such circumstances, it is not surprising that for at least the first twenty-five years the engineering students outnumbered all others, sometimes constituting two-thirds of the student body. Rightly, then, the early history of its College of Engineering was in a large measure the history of the University of Illinois; and without the insight, ability, and enthusiasm of the first professor of engineering that history might have been very different. It was unfortunate for the University of Illinois that the condition of its finances made it necessary to permit Professor Robinson in 1878 to go to the Ohio State University; but it was fortunate indeed that his ideals and methods had so permeated the work of the College that they continued to dominate after his departure. Happily, the principles of sound engineering education are now so thoroughly understood, and the place of the institution is so well established in the estimation of the profession and of the people of the state, and the work of the College of Engineering has attained such a momentum, that at present it is not a matter of any great moment who the workers are; but the University of Illinois, and particularly its College of Engineering, owe to Professor Stillman W.

Robinson a debt for his services in a critical period of its history that has never been adequately recognized.

In closing, permit a few remarks about the personality of Professor Robinson. He was always patient and painstaking in his instruction, and ever ready to help the slow students. Because of the then low admission requirements and of the labor system, there were many ill-prepared and tired, if not naturally dumb, students at the University of Illinois in those days; and the speaker personally knows that many were the days that Professor Robinson was late home to meals because he stopped to help a slow student; but it is certain that no one ever saw him impatient or heard a word of complaint. It is marvelous that a man of his quick perception and of his ambition and fertility did not rebel at the restraints of the long and arduous recitation work required of him; and that he did not rebel is proof that he had the spirit of a true teacher as well as the ability of an inventor and an investigator. In those days he was not strong of body, but none put in more hours at the University than he, none were back earlier after dinner or worked later in the afternoon; and he worked long into the night either in his study or in the laboratory. Many and many a night did the speaker work with him in the physics laboratory until after midnight, but he was always out for a recitation at 7:30 in the morning. He was a rapid and expert worker with his hands, and spent not a little time in the shop making illustrative and experimental apparatus, which, owing to the scarcity of money, must be made with his own hands or not at all. But the fact which most astonished his co-laborers was his rapidity as a draftsman and a designer. A number of incidents are related of his getting a new idea concerning some proposed machine or

apparatus, and of his appearing in an incredibly short time with a complete set of working drawings. And the thing that most astonished the students who were compelled to study the wretchedly poor text-books of that day on calculus and mechanics, was his ability to handle the mathematics of those subjects. The text-book on resistance of materials, probably the first on that subject in the world, and which he began to teach to the class of which the speaker was a member, before the text-book was wholly out of the press, contained a list of complicated problems that had never been solved; and Professor Robinson was not slow to accept the challenge, and from time to time he published in Van Nostrand's Engineering Magazine, the only engineering periodical of that day, solutions of these problems, which his students viewed with wonder and admiration unbounded. And now that the speaker by personal experience has come to know something of the tax and exhaustion of recitation room work, of conferences with students, and of administrative matters, he wonders still more when Professor Robinson found time to do such work, much less the inventive work which he did during his pioneer days as a Professor of Mechanical Engineering and Physics.

Such was the pioneer work of Professor S. W. Robinson at the University of Illinois, a work that that institution is always glad to honor, as also all who know of it.

In Behalf of the Alumni

CHARLES FREDERICK MARVIN, M. E. '83
United States Weather Bureau, Washington, D. C.

Mr. President and dear Friends:

IT is difficult for me to convey adequately to you the feelings of mingled pleasure and diffidence with which I undertake to speak at these exercises in memory of our beloved Professor Robinson. I was one of his first pupils at this University, and while I realize how much better others could discharge this task, yet I am sure none feels animated by a greater admiration, a deeper appreciation, or a more affectionate remembrance than mine, and I hope these feelings may help me to speak worthily of him.

Called to the Ohio State University to establish a course in Mechanical Engineering and to fill the chair of Physics, made temporarily vacant by a leave of absence granted Professor Mendenhall, Professor Robinson entered upon his duties in September of 1878. Then, also, began my own work at this University as a freshman, and my acquaintance with Professor Robinson. It is my purpose in these brief remarks, to mention only a few of the events of his life that came under my personal notice during my stay at the University ending in 1883. It was my great pleasure to spend a morning with Professor Robinson in November about two years ago. This proved to be our last meeting, and I shall always cherish with the greatest affection the memory of the happy moments passed with him on this occasion, when, as if by some common impulse, each of us seemed prompted to talk over early student experiences, he of his trip west to Ann Arbor and his work there and both of us of the times and incidents at this University beginning with 1878.

The great majority of those present today are hardly conscious of the extensive and rapid development of this

great institution since that date. There are a few, however, who have been with it over the whole period and these will recall those early years when all the educational activities of the University were carried on in the one building we now occupy. The laboratory of the new Department of Mechanical Engineering occupied the basement rooms at the west end of the building. The task of organization devolving upon Professor Robinson, called for original and pioneer work in many senses of the word. In those days manual training and the mechanical laboratory were just beginning to be recognized as valuable adjuncts in educational methods. It was not possible then as now to pattern after fully developed and perfected laboratories in other institutions, nor to profit by the advice and experience of fellow-workers in the same field. Professor Robinson was then a pioneer authority on these questions and introduced means and methods more or less original. Even in the few years that have since elapsed, these and similar methods have been elaborated and introduced at educational institutions all over the land, yielding results of inestimable value to the mechanical professions and manufacturing industries everywhere.

As one considers the present splendid equipment in Mechanical Engineering of the University it is hard to realize that the foundations for this work were laid in 1878 when Professor Robinson began his work in the basement rooms of University Hall. Funds for improvement were soon provided and the "Mechanical Laboratory," the first separate building for student work to be erected upon these grounds, was added to the Campus during the summer of 1879.

It is probably not generally known that the furnishings and equipment of the new laboratory contained numerous illustrations of Professor Robinson's ability to devise and supply special facilities of a novel and up-to-date character such as are often not easily obtainable in the customary market. The small steam engine needed to drive the machinery of the prospective laboratory is worthy of mention in this connection. Steam engineers were then beginning to take advantage of the benefits and economies to be realized by the double and multiple expansion of steam in engine cylinders, and were introducing the more efficient automatic cut-off governing valves in place of the old well-known throttling valve and ordinary ball governor. The new laboratory, therefore, must have a double-expansion, high-speed engine with centrifugal governor and automatic cut-off valve; not exactly on the score of economy, because the advantages of the new features are mostly subordinate to other considerations in an engine so small as that required, viz., 10-horse power, but the new model was desired chiefly as an illustration of the application of important mechanical and thermodynamic principles. Since such an engine could not be directly purchased at that time, Professor Robinson worked out its design, prepared all the drawings and specifications, and supervised the construction of the engine in one of the machine shops of the city.

Always ready to extend opportunities to students seeking work, Professor Robinson employed some of them to install the shafting and machinery of the new laboratory, and to complete other details of the shop equipment. Thus during the course of the first 18 months of his incumbency Professor Robinson succeeded in fully establishing the

work in Mechanical Engineering at the Ohio State University, and in housing it in its own building.

As a teacher of technical principles and their application to the solution of every-day problems in engineering, Professor Robinson's instruction was always simple and clear, and often of rare practical value. In after years I have repeatedly recalled some special item of instruction received in the Mechanical Laboratory on some particular operation or method, or used in pointing out some common fault or mistake made by the average professional workmen. It may not be inappropriate to mention a single illustration. I especially remember the instructions upon the right and the wrong way to join steam or other pipes when right- and left-hand threaded fittings are employed. The procedure is so simple and so obviously correct when once pointed out, and leaky or imperfect joints so easily result from its neglect, that one would suppose this valuable detail of knowledge was well understood by the average workman everywhere. Nevertheless, I have yet to meet the mechanic, however well trained, who seems to know and to practice the correct method of "making up" right- and left-hand threaded pipe connections. I realize now, that the whole matter is but an example of the thoroughness and practical value of Professor Robinson's teaching.

In the class room he utilized the calculus and other mathematical processes for the solution of this or that problem as so many available tools, much the same as he would employ a file or a chisel or some machine tool in the workshop to produce a given form or effect. We can hardly conceive of a student in the shop, for example, with such a vague idea of his task that he does not distinguish his tools from his work. In the class room, however, every-

thing is new and unfamiliar to students when they are pressing rapidly onward in the acquisition of different branches of advanced knowledge. To them, especially, the new technical studies are certain to be more or less abstract and difficult of comprehension. It is no easy matter for them to readily distinguish between tools and task, for both are alike intangible and mostly the creatures of the conceptions. I think the student needs all the aid possible to enable him to discriminate between what I have called his tools and his task. I am here referring more particularly to the use of advanced mathematical methods in the discussion and solution of problems in physics, mechanics, thermo-dynamics and the like. His writings show how effectively Professor Robinson could employ analytical methods when occasion arose, and this practical use of mathematical tools in his personal studies and investigations doubtless helped him to present matters in a way readily comprehended by his pupils, who seem unanimous in praise of his methods of mathematical instruction.

The establishment of the course in Mechanical Engineering, including building and equipping the new Mechanical Laboratory, and attention to class-room work, by no means absorbed Professor Robinson's activities. It is well known that he took an active part in the work of the American Society of Mechanical Engineers, was the author of many excellent technical papers and the inventor of a great variety of mechanical devices many of which proved profitable patents. I can mention at this time but a few of the many things he accomplished. During the summer vacation of 1879, while the Mechanical Laboratory yet occupied the basement of University Hall, Professor Robinson engaged me to help him construct models of improve-

ments in the telephone which was then just entering upon its career of marvelous utility. After a few weeks spent on this problem, gratifying results were obtained, an application for a patent was filed, and the invention was subsequently disposed of to advantage. I was particularly fortunate during my course at the University, in obtaining from Professor Robinson the privilege of constructing for the market two simple devices previously patented by him, namely his Odontograph and his Photographic Guides and Trimmers. The demand for these articles was no greater than a student could readily supply without neglecting his University work, nevertheless the sales brought in a small but most acceptable little income which helped defray current expenses. This instance is but one of many cases in which Professor Robinson afforded students opportunities for profitable employment, and indeed I think he was quite indifferent regarding his own profits provided the student fared well.

Of all the inventions patented by Professor Robinson, the greatest and probably the most profitable was the flattened and threaded shoe-sole fastening. This device and the long list of machines invented to manufacture it and to drive it rapidly and automatically through the sole, required several years for their ultimate development. They contain numerous illustrations of his great genius and his ability to utilize a profound knowledge of mechanics in the solution of intricate practical problems.

When the Hon. H. Sabine was State Commissioner of Railroads for Ohio, Professor Robinson was chosen as one of three inspectors employed to examine the tracks, bridges, and mechanical equipment of all the railroads in the State. This work gave Professor Robinson opportunity to minutely

examine into existing engineering works and practices on a large scale, opening a new field of activity for his great genius and originality. Probably some of his best scientific work is embodied in the splendid technical papers submitted with his reports to Commissioner Sabine and published in the Ohio Railway Reports, particularly those for 1881 and 1884. Keenly alive to the hidden dangers lurking in the possible excessive stresses in bridges, caused by dynamic actions and the cumulative effects of vibrations, he devoted a great deal of his attention during his inspections, to procuring diagrams of the deflections and oscillations of bridges under rapidly moving trains. For this purpose he devised an instrument called a "bridge indicator" which, when properly installed in connection with a bridge under examination, gave him a diagram showing all the characteristic deflections and vibrations of the bridge whenever a train crossed.

Upon beginning his inspection of railway bridges he felt at once the need for full and complete numerical formulæ for computing the strength and resistance of columns, floor beams, eye bars and other important members especially of iron and steel structures. The available material of this character was scanty, incomplete, and inadequate for the purpose desired. Owing to the great labor and difficulty of developing the equations from the strictly analytical basis very few of these could be found in print and, even among these, important terms of the equations were often omitted in order to simplify the mathematics. On the other hand formulæ in current use frequently based only upon experimental data, are mostly empirical and cannot be safely applied to existing conditions that may often differ greatly from those comprised in the experiments

from which the results are drawn. Professor Robinson's solution of this difficult problem forms an exceeding valuable chapter upon the "Strength of Materials." The theoretical equations admit of a very wide application and are themselves a lasting monument to this great man.

His trips of inspection carried him over many thousands of miles of rails and it is quite certain he experienced a good deal of that discomfort we all know more or less about, which is caused by the jolting, lurching and rocking of the average railroad train even under the greatly improved conditions of the present day. These experiences no doubt prompted him to write the paper, "Railway Shakes," in which he comments on the care and attention the average section boss and the track hands take to preserve the accurate horizontal alignment of the rails whereas these men, lacking a technical knowledge of the importance of exact vertical alignment and having no simple means of easily discovering its defects, either fail to eliminate or even unwittingly produce false vertical adjustments that may often explain much of the discomfort the traveler feels.

A still more important contribution to railway engineering is found in Professor Robinson's characteristic paper on "Easement Curves." The customary text-books and similar sources of information point out that it is impossible for a rapidly moving train to pass from a stretch of straight track onto a simple circular curve or from the curve onto the straight track again without serious lurchings and disturbance at the points of tangency, no matter how correctly the circular curve may be laid out. It is explained also that so-called easement curves are required at the points of tangency to produce a gradual transition in curvature from the straight track to the circular curve and vice versa. The

text-books rather leave the matter with these broad generalizations. But how can the engineer in the field accurately stake out these easement curves and join them properly to the great circular arc constituting the main curve? The occasion of his inspection of railroads brought this matter to Professor Robinson's attention and his absolute mastery of the dynamics and mathematics of the problem readily indicated the complete solution. He worked this out fully for the field engineer, giving him all the tables, numerical data, and instructions needed to lay out any required easement curve which, mathematically, is nothing but a piece of a great spiral having an infinite radius of curvature at its junction with the straight track and the same radius as the main curve at the point of tangency. The next time you make a railway journey just take notice of the motion of the train as it speeds along, possibly at the rate of a mile a minute, and swings smoothly and easily around the curves —often traversing a whole curve in the course of a few seconds. Just think what it means, dynamically, to transfer without shock or serious disturbance the hundreds of tons of swiftly moving matter or the train from straight line to curvilinear motion and back again to linear motion in a few seconds. The possibility of doing this in the case of the railway train resides first of all in staking out the track. How this may be done has been very beautifully worked out by him whose name we honor today, and if the engineer who stakes out the track and all those that follow after him but do their parts well then our swiftly moving train will round its curves with barely perceptible disturbance. Others have worked over this same problem, but his solution seems best of all in the ease of its application and in the absence of sacrifice of technical correctness.

This brief mention of some of the work and writings of Professor Robinson will serve to remind you of a little that he has done, but his publications themselves and especially the potential power for great benefits to mankind of this splendid Institution for Mechanical Engineering, organized and inaugurated by his labors, constitute far greater monuments to his memory than anything I can say to-day.

Some great minds seem capable of dealing only with broad generalizations, whereas, the working out of the details, a task often left to others, is nearly always the ultimate necessity before a generalization can be reduced to a useful working application in every-day affairs. Professor Robinson's work affords us a splendid inspiration to give close attention to details. This work is greater and better of its kind just because he never neglected any essential element, but with the master's hand he shaped the analysis of this problem so as to include all the factors of any consequence to the ultimate result.

In the affairs of life about us at the present day we are often made to feel that success follows upon selfishness, ostentation, personal push, and the like. All such qualities were absolutely foreign to the character of him of whom we speak. Great modesty of his own worth and work; constant thought and consideration for those about him; generosity in securing and contributing to their welfare; that grand old rule—The Golden Rule—all seem to have been his guiding and controling impulses.

Let me earnestly commend all these, his excellent qualities, to you and may each of us be found, like him, among those who push and struggle to help their fellow men onward and not to force our neighhor aside and downward in order that we may ourselves reach the higher places.

In Behalf of the Ohio State University

EMBURY ASBURY HITCHCOCK, M. E.

Professor of Experimental Engineering

THE average young man while pursuing his course in the college or university and coming in daily contact with associates, naturally forms friendships, which, before completion of his course, become so strong that it seems as if they must remain for all time. When commencement is over and the separation time comes, it is with much regret that we part from the comrades of those days. Although at the time resolutions may have been made to keep in close touch with each other, as time goes on and the thoughts and energies of our entire being are taken up in carrying forward to completion the tasks which have been our fortune to accept, we very soon forget those excellent resolutions and those friendships formed during those days.

This strenuous life intervenes to such a degree that oftentimes the word comes to us indirectly of the great success attained by one of those college friends.

On starting out in life, this young man naturally falls in with associates of about the same age, but possibly of other callings or professions than his own. However, if wise, he will naturally crave the friendship, good will and guidance of those older and of larger experience, not necessarily of those in the same line as he is pursuing, but men in other walks of life, men from whom he can gain knowledge, receive guidance and help. No young man can be so self-sufficient that he cannot profit greatly by the advice of those older and of greater experience.

During my eighteen years of service at this institution, there have passed into the life beyond, three men for whom I, as many others, held the highest esteem. To have known and been associated with these three characters has been of untold value in that their knowledge and advice were so

freely given and that their definiteness of purpose, untiring devotion to duty and highest integrity have been a goal to be constantly sought after.

The first to whom I refer was a prominent business man of Columbus, one of those self-made men, who had been compelled to start out in life at a very early age and by constant application to duty, by the highest integrity in business methods, by great devotion to church and family, he left at the prime of life the greatest possible legacy, that of a successful life and a good name.

The second was one whom I came to know and most highly esteem soon after entering upon my duties at this University; one whose loss was most keenly felt by his associates, a man among men; one whose opinion was sought and valued; one who gave the best twenty years of his life to the upbuilding and advancement of this University, in honor of whom one of our engineering buildings is named. On a bronze tablet in that building are these highly appropriate words: "Who by his arduous and successful labors for the advancement of his institution, his pupils and his community, won the love and admiration of all who knew him."

To speak of the third, the one whose memory we are here to honor, is in one way a difficult task, but when viewed in another a joyous one. It is difficult for the reason that, having served as his assistant in the department of this University which he created, having been a member of his household where for months, during the evening time, problems of mutual interest were discussed, having traveled with him on somewhat extended trips and having been, during these latter years of his life, in almost constant communication with him, there was a steadily increasing admi-

ration for and also a dependence upon this character. Although the influence prevails and always will, there is a feeling of groping in the dark, of trying to grasp something tangible, but in vain.

It is a joyous task to speak of him because the half has not been told, because we, his associates and co-laborers in this institution, are familiar with his achievements and good deeds, we glorify in them and would therefore give them to the world that many may know and be inspired by the works of this great and good man.

How well I remember my first meeting with Professor Robinson. It seems but yesterday. As the result of correspondence, knowing him at that time by reputation and as the inventor of the Odontograph (an instrument used for laying out forms of gear teeth), I arrived in Columbus and met him at his residence one morning during the Christmas season of 1892. We soon adjourned to what was known then and up to quite recently as Mechanical Hall. Although there was a fair equipment for instructional work in metal and woodworking, the equipment for experimentation and research was very meagre indeed. To-day it would hardly seem possible to one passing through our present laboratory and having pointed out the equipment with which Professor Robinson was compelled to work at that time, that instructional work could be carried on. That he could accomplish so much with so little has always impressed me with the fact that here indeed was a most resourceful man. Thus we are made to realize that the strength of a University is not fully dependent upon fine buildings and elaborate equipment, but does depend to a very large degree upon the ability, resourcefulness and knowledge of the "man behind the gun."

At this time was my first introduction to the little instrument known as the Pitot tube. One might say that Professor Robinson had a Pitot tube laboratory, for on account of the simplicity of this correct little instrument, he had applied it in many directions. It was some years previous to this time, when the natural gas fields of Ohio were discovered and the late Dr. Edward Orton was in a quandary to know of some method for measuring the large flow of gas from the wells, he appealed to Professor Robinson, who at once suggested this little instrument, the result of which is that this has been the standard method for this purpose ever since that time. It is only within recent years that other engineers recognized what Professor Robinson saw many years before in this little instrument. It appealed to him on account of its great simplicity, its accuracy and its dependence upon a fundamental law. The fact of its great simplicity made many engineers skeptical.

Just at this time the field of electric lighting was extending very rapidly and with the introducton of the incandescent light, one of the problems facing the engineer was close regulation on the part of the steam engine which was usually of the high speed class. Professor Robinson designed and had constructed and applied to the engine of the laboratory, a form of governor which in principle is the same as in universal use at the present time, and although the honors as the inventor are bestowed upon another, it is believed by many that Professor Robinson could have claimed priority if he had so desired.

There stands in the laboratory to-day, a machine for the purpose of transmitting and measuring power. This also is an illustration of Professor Robinson's originality

and simplicity in design,—a machine which is far more accurate than others constructed for similar purposes.

Although Professor Robinson invented, designed and constructed many successful appliances, he was not chagrined or in the least disheartened when something which he had constructed strictly according to theory, did not work out in practice; in fact he seemed to get considerable enjoyment out of the fact that this was so and in speaking of it, would say, "That is the way it should not be done."

At this time the instructional work, which at the present time is carried on in the departments of Mechanical Engineering, Applied Mechanics and Industrial Arts, was under his direction. I often marveled at the energy displayed when, after conducting three recitations and then during the afternoon assist in laboratory and general department work, he would devote his entire evening to some engineering problem and often become so absorbed that it was indeed a very late hour before retiring. His great endurance and vitality speak well for that early life on a farm among the hills of Vermont.

Professor Robinson was not given to after-dinner expressions or to much speaking in public. He did not hesitate to express the opinions he may have held on some particular subject, although he may have been very much in the minority.

Some of us recall how in 1902, six years after resigning from active service in the University, he was in attendance at one of the commencement luncheons and was invited to sit at the speakers' table. We can imagine his hesitancy when called upon for a few words and we remember well his theme to be that nearest his heart, "science and engineering." In discussing engineering education he expressed

himself here in public as he had often done privately, namely, that the young man who came to this University for an engineering training should be as well prepared as possible and should not be compelled to devote a considerable portion of his time to the study of a modern foreign language. It was at this luncheon also, when his remarks became so highly scientific in that he discussed the mathematics of a point, that to many listeners the intellectual atmosphere became somewhat hazy. There was, however, a sudden clearing up and an electrification of the company when he announced his intention to endow a fellowship in engineering. In his letter to the Trustees relating to this fellowship are these words: "I wish if practicable that such fellowship shall be awarded as a prize to some graduate engineering student who shall have shown marked interest and ingenuity in the study and investigation of some engineering problem or problems, in order to give him further opportunity for study and investigation and with the understanding that he shall devote his entire time to study and research." A few years later, feeling that the revenue from this fellowship fund was not large enough to make it sufficiently attractive to those graduates of this or other institutions who had several years of experience and therefore would make the most desirable investigators, he increased this endowment fund so that the annual income now is $500, the most heavily endowed and only full time fellowship in this University.

During the past fifteen years there has been an enormously increasing demand for electrical energy for different purposes that as a consequence there have been great strides in steam power plant construction. Professor Robinson fully appreciated what was being done in this direction and

therefore realized that the young engineer should receive practical training along the line of steam generation, that he should be able to apply and try out, as taught in the class room, those principles underlying the combustion of fuels. He also saw the opportunities for investigation and research in this same field, so with this in mind, donated in 1900 to the Mechanical Engineering Department of this University, a most valuable experiment boiler with many accessories. As a result of his generosity in this direction, over two hundred graduates in mechanical and electrical engineering have profited much more than they otherwise would and some few who are specializing in the field of fuel engineering are achieving very marked success and bringing credit to this University.

With the termination of active service in this University, his work did not cease. I do not believe he considered favorably for one moment the resting upon the fruits of his labors. A life of ease for him would indeed have been a life of toil. He believed fully that the Almighty endows all with certain gifts and faculties and that all should render the very best possible account of their stewardship.

During his University period he taught the subject of Mechanism by lecture from original notes. On resigning he at once turned his attention to the publication of these notes in text-book form and as a result brought out what is considered the most original book on the subject.

This branch of Mechanical Engineering had a great fascination for the Professor and therefore it is not surprising that he gained a national reputation in this particular direction and was considered second to none in the country.

In matters generally relating to engineering and engineering education, Professor Robinson was strictly a pro-

gressive and not a standpatter. This is shown by the active part he took in the organization of that society which to-day is known as the Society for the Promotion of Engineering Education, and the very active part which he took at the first meeting of the American Society of Mechanical Engineers, held in New York City, in November of 1880,—a society which to-day has a membership of about 4,000. At this meeting he read two papers, one entitled, "The Efficiency of the Crank," the other, "Cushion Adjustment in Engines." A glance through the published transactions for this annual meeting, at which some seventeen papers and addresses were given, it is at once seen that Professor Robinson's papers were very highly mathematical as compared with the others, so that we may rightly claim that he was the first to introduce higher mathematics into the meetings of this national society. It is also worthy of note that he was one of those in attendance at the organization meeting of this Society at Hoboken, New Jersey, in April of the same year and was referred to as "one of those coming from as far west as Ohio."

He was at work constantly upon the development of some special device or machine. He was the principal in more than fifty inventions, many of which have been patented in the United States and foreign countries. His last development was that of a machine for the grinding of lenses having two different radii, he receiving notification from the United States patent office of its being allowed, a few days before his death.

The great esteem and admiration held by the students for Professor Robinson was very manifest. There never was a complaint on the part of the indifferent man that he did not get a "square deal," and on the other hand, never

have I heard from this teacher one single word or utterance which would indicate impatience with the drone. In fact, his feelings were that of sympathy or sorrow that any man could be so short-sighted as not to make the most of every opportunity and to take all the advantages within his reach.

It has been said that although the students held him in the highest admiration, yet to these he did not seem as approachable in a social and comradeship way as others. It was always a great pleasure to him to meet the student personally and extend to him those little helps and encouragements which are often times of so much value to a man who cannot always grasp many essential points when presented in the crowded classroom. If he had occupied the highest possible place in public life and was exalted of all men, the very humblest citizen would have been most welcome to his consideration. It was indeed an impressive sight to me when in company with him we journeyed to Pittsburgh, unexpectedly visited the Westinghouse Electric and Manufacturing Company, and upon the word going forth that Professor Robinson was in the building, there was a gathering from many directions of former students, all so anxious to do him honor and grasp the hand of him who had labored for their advancement and welfare. The trembling voice and moist eye indicated how great was his appreciation of such marked attention.

It was in the spring of 1895 that a little incident occurred which impressed me with his conscientiousness relative to his obligations to his pupils, in that he considered it his duty at all times to give them value received. He was called into the northern part of the State to use the Pitot tube in the gaging of some stream and as was his custom, he left with his assistant problems and exercises for

his several classes sufficient to cover the period of his absence. The work did not progress as rapidly as he had anticipated, so that his return was delayed one day. The students, however, did not want for he made use of the telegraph and sent a most lengthy message which to the operator must have been some new and strange code as there were many questions and problems in mechanics and mechanism.

He was extremely modest and retiring and never mentioned or referred to his achievement only with much hesitation. This characteristic is illustrated in his text-book on Mechanism, where in explaining the different instruments for the laying out of gear teeth, naming them by their designer or inventor, that instrument originated by himself, is spoken of in a general way only and the reader would never know from the text, the name of the inventor.

Even for professional services, his charges were not at all commensurate with his reputation and the service rendered. A characteristic quite the opposite from the average professional man in this day and age.

The news of achievements of others in the engineering world was always received by him with the greatest pleasure and he always took great delight in relating that which others had accomplished although in some cases, he himself may have been the guiding thought in the conception. His great thoughtfulness and consideration relative to the labors of his assistants and the words of commendation for conscientious and full services given were of the greatest possible inspiration and created feelings of love and loyalty that no time could erase.

He was most resourceful and believed thoroughly in solving any problem or constructing a machine in the simplest

possible manner, as he used to say the success of an invention depended largely upon its simplicity. He believed in the combination of theory and practice, usually giving the former precedence in the development of an idea and then applying that practical knowledge largely gained during those four years of apprenticeship at the machinist trade just previous to his entering upon his University course. There was nothing along mechanical lines in which he would not at once be greatly interested, with one exception, and that was a perpetual motion machine. Not only was simplicity characteristic of his engineering achievements, but this same quality prevailed throughout his daily life and in all humility and simplicity did he worship Him who controls the destiny of us all.

His great interest for this Institution was always manifest and its advancement was always of great joy to him. He always entertained the warmest feelings for his early associates with whom he stood shoulder to shoulder and labored for its advancement. Not only did his generosity extend, as we have seen, to this University, but in many, many directions did his hand follow the dictates of his large heart and make for joy and gladness, but yet not seen or heard of men.

Although we, his associates, may have known him many years, yet it is impossible for us to realize or have much conception of the magnitude of his influence and the inspiration and enthusiasm imparted to the many which makes for the advancement of this world of ours and the uplift of humanity.

To the memory of this great man, who, when as a young farmer boy, started for the goal he attained, who by self-help obtained his education at one of our leading state Uni-

versities, who served his country as an engineer, who for many years served most faithfully the cause of education at two state Universities, who was inspector of railroads in Ohio, consulting engineer for many interests, designer of bridges, investigator, inventor and author; a true friend, a wise teacher, an honored citizen and benefatcor, we hope in the near future there will stand among the engineering group of buildings on this campus, a completed building which will receive the name of Robinson Hall.

APPENDIXES

MEMORIAL

At a special meeting of the University Faculty, held November 1, 1910, the following memorial was adopted:

STILLMAN WILLIAMS ROBINSON, Emeritus Professor of Mechanical Engineering, died on Monday morning, October 31, 1910.

Professor Robinson was born on a farm near South Reading, Vermont, March 6, 1838. His early life was that of a country boy, but his love of mechanics led him to the shops and he served a four-year apprenticeship to the trade of machinist.

He earned the money to defray the expenses of his early education and to prepare himself for college. In 1860, he left home to attend the University of Michigan. He made the journey largely on foot and met his expenses by working as a machinist on the way and arrived at Ann Arbor with fifty dollars more than the eight with which he started.

He graduated from the University in 1863 with the degree of Civil Engineer, having supported himself through his college course by his skill as an instrument maker, in particular graduating thermometers. This led to his first invention, made while in college, of a machine for graduating such instruments. Notwithstanding the difficulties under which he labored, he earned the reputation of a brilliant and original student.

After graduation, he entered the government service as assistant engineer in the U. S. Lake Survey, remaining in

that service until 1866, when he returned to the University of Michigan as instructor in Engineering.

He left the University of Michigan in 1870 to become Professor of Mechanical Engineering and Physics in the Illinois Industrial University, now the University of Illinois. There he established the Department of Mechanical Engineering, which was the first to be established in a state university in this country.

It is interesting to note, as illustrating his versatility, that while there he designed and constructed the tower clock now furnishing time at the University.

In 1878, he occupied the position of Dean of the College of Engineering at that institution. The same year he was called to the Ohio State University as Professor of Physics and Mechanical Engineering. In 1881, the chair was divided and he became Professor of Mechanical Engineering, occupying that chair until he resigned in 1895 in order to devote his time to his extensive professional interests. In 1896, in consideration of his distinguished services as a scientific inventor, investigator and writer, the Ohio State University conferred upon him the degree of Doctor of Science and in 1899 elected him Emeritus Professor of Mechanical Engineering.

Professor Robinson was a man of great originality and inventive genius. He secured about forty patents, many of which were fundamental and of great value. His inventions were based upon scientific research and mathematical investigation, the results of skilful study. They were designs rather than accidental discoveries. He was also the author of important books and papers presented before learned societies, which are marked by the same quality of thorough research and originality. When the Ohio gas fields were

first discovered the problem of measuring the volume of flow was referred to Professor Robinson and solved by him in his brilliant application of the Pitot tube, resulting in the methods now in universal use.

His interest in education was always great and led him in 1890 to organize an association composed of mechanical engineering teachers which, in 1893, developed into the present Society for the Promotion of Engineering Education. His interest in and love for the University did not cease with his retirement. He made at various times valuable donations to the equipment of the Department of Mechanical Engineering and finally established the Robinson Fellowship in Engineering as a permanent foundation.

As a man, Professor Robinson was an indefatigable worker. There was no limit to his enthusiasm and ambition in his profession. Personally, he was modest and retiring never claiming credit for himself though most generous in according it to his assoicates. His nature was deeply sympathetic and very kindly. He was inflexible in his devotion to his duty and to his principles of integrity and honor. He was greatly interested in the work and success of those around him, both colleagues and students, and impressed his own enthusiasm upon their efforts, encouraging, stimulating and rewarding them. His memory and influence will long be felt in the lives of those who follow after him and have taken up his work where he left it.

Your committee recommends the following action:

Resolved, by the University Faculty, That in the death of Professor Stillman Williams Robinson, the University loses one whose great and loyal service has left a deep impression on the history and development of this Institution, the Faculty, an associate whose ability and scholarship

has earned him a national reputation, and a friend whose personal influence has helped those around him in their work and professional advancement.

That we extend our deep sympathy to his widow and family in their bereavement and sorrow.

Resolved, That these resolutions be spread upon the minutes and a copy sent to the family.

N. W. Lord,
Edward Orton, Jr.,
Wm. T. Magruder,
Committee.

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